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ORIGINAL ARTICLES.

PHYSIOLOGIC VARIATIONS IN THE SIZE OF MARIOTTE'S BLIND SPOT.*

BY HOWARD F. HANSELL, M.D., PHILADELPHIA, PA.

THE study of Mariotte's blind spot, as apparent from the text-books on physiology and ophthalmology, has never been carried to an exhaustive extent. Indeed, one is struck by two noticeable peculiarities of authors, unfortunately illustrated in other subjects, that the original delineations have been handed down through the successive generations and that these delineations always represent one and the same eye. The principal reason for this neglect would seem to be that the size of the blind spot and its relation with the foveal region are of little practical value in the diagnosis of disease and that its recognition and the knowledge that such a blind spot existed in all human eyes were sufficient. While I am unable to deduce from my analysis of a rather small number of eyes any conclusions that would mark any decided progress in ophthalmology, I have found the examination to be interesting and profitable and have been able to verify, by the projection on the visual field of the limits of the blind spot, the findings that seemed consistent with the ophthalmic appearance of the disc and the state of the refraction. With the valuable co-operation of my friend, Dr. N. D. Pontius, assistant in my service in

*Read before the Ophthalmic Section of the College of Physicians of Philadelphia, October 17, 1899.

the Polyclinic Hospital, who has devoted much time and care to the exact measurements of the blind area in the cases quoted below, I have secured some fields that show points of difference that are worthy of note. Many of the cases were those of the pupil-physicians taking courses in the Polyclinic and assistants connected with the institution, and a few were patients selected on account of their intelligence, therefore the outlines are more nearly accurate than would be obtained were all the cases those of patients in the clinic. The accurate measuring of the fields requires much patience on the part of the examiner and a considerable degree of intelligence and co-operation on the part of the examined. The method adopted was to mark a small black cross on a clear sheet of paper and with a black-pointed pencil, chosen so that it presented a sharp contrast in the shade with the paper, fix the patient's head at exactly 33 cm. distance, and, with the second eye bandaged, the pencil is moved from the seeing field into the blind field, thus making the projection of the disc upon the paper appear at its smallest and probably truest limits. I considered this plan better than first to find the blind spot and to define its limits by moving the pencil-point eccentrically until it passed into the seeing field. By the latter method it was feared that its size would be made unconsciously and involuntarily larger.

I.—Emmetropia: 37 Individuals, 74 Eyes.

Distance from the point of fixation to the center of the blind spot.

Right Eyes: 8.5, 7.7, 9, 8.1, 8.2, 8.5, 8 5, 8.2, 8.2, 8.3, 7.2, 7.3, 7.2, 8, 8, 8, 8, 7.7, 8.5, 6.8, 9, 8, 8, 8.5, 8.3, 8.4, 8, 9, 7, 8.4, 8, 9, 8.7, 8, 8, 8, 8.7.

Left Eyes: 8, 8, 8, 9.1, 8 9, 8, 8.7, 7.8, 8, 9, 8, 7.7, 7.5, 8.5, 7.7, 8, 8.9, 8, 7.9, 7, 9, 7 3, 7.7, 8, 8, 9, 7.7, 8.4, 7.5, 7, 7.5, 8, 7.7, 9, 8, 7.4, 7.7.

In R.E. the longest distance = 9 cm.
In L.E. the longest distance = 9.1 cm.
In R.E. the shortest distance = 6.8 cm.
In L.E. the shortest distance = 7 cm.
The average distance in R.E. = 8.1 cm.
The average distance in L.E. = 8 cm.

II.—HYPEROPIA: 11 INDIVIDUALS, 22 EYES.

Right Eyes: 8.5, 7.8, 7, 7.4, 8, 8.2, 7.5, 9.2, 7.5, 9, 9.3.
Left Eyes: 9.5, 9, 7.5, 7.2, 7.7, 8.7, 8, 8.7, 7.7, 9.5, 9.
In R.E. the longest distance = 9.3 cm.
In L.E. the longest distance = 9.5 cm.
In R.E. the shortest distance = 7 cm.
In L.E. the shortest distance = 7.2 cm.
The average distance in R.E. = 8.1 cm.
The average distance in L.E. = 8.4 cm.

III.—MYOPIA: 4 INDIVIDUALS, 8 EYES.

(1) R.E., M.=8 D. 10.3 cm. Longest distance=R.E. 10.3.
L.E., M.=8 D. 6.5 cm. Longest distance=L.E. 13.5.
(2) R.E., M.=2 D. 8 cm. Shortest distance=R.E. 8.
L.E., M.=2 D. 8.2 cm. Shortest distance=L.E. 6.5.
(3) R.E., M.=8 D. 8 cm.
L.E., M.=7 D. 13.5 cm.
(4) R.E., M.=9 D. 8 cm.
L.E., M.=9 D. 8 cm.

The average distance in R.E.=8.5 cm.
The average distance in L.E =9.03 cm.

Distance of the approximate center of the blind spot below the horizontal line:

In Hyperopia: R.E., average 10.6 cm.; longest 25 mm., shortest 2 mm., and 2 coincident. L.E., average 7.3 mm.; longest 14 mm.; shortest 3 mm., and 2 coincident.

In Myopia: R.E., average 9.07 mm.; longest 19 mm.; shortest 5 mm., and 1 coincident. L.E., average 9.03 mm.; longest 17 mm.; shortest 11 mm., and 2 coincident.

In Emmetropia: R.E., average 10.3 mm.; longest 20 mm.; shortest 6 mm., and 1 coincident. L.E., average 9.8 mm.; longest 22 mm.; shortest 2 mm., and 1 coincident.

Emmetropia: R.E., long diameter, average 30.9 mm.; longest 42 mm.; shortest 19 mm. L.E., long diameter, average 31.4 mm.; longest 52 mm.; shortest 17 mm.

Hyperopia: R.E., long diameter, average 35 mm.; longest 50 mm.; shortest 14 mm. L.E., long diameter, average 33.6 mm.; longest 65 mm ; shortest 15 mm.

Myopia: R.E., long diameter, average 40 mm.; longest

50 mm.; shortest 30 mm. L.E., long diameter, average 36 mm.; longest 45 mm.; shortest 25 mm.

Emmetropia: R.E., transverse diameter, average 26.8 mm.; longest 37 mm.; shortest 16 mm. L.E., transverse diameter, average 26.4 mm.; longest 40 mm.; shortest 17 mm.

Hyperopia: R.E., transverse diameter, average 28 mm.; longest 40 mm.; shortest 15 mm. L.E., transverse diameter, average 26.9 mm.; longest 37 mm.; shortest 15 mm.

Myopia: R.E., transverse diameter, average 35 mm.; longest 40 mm.; shortest 20 mm. L.E., transverse diameter, average 35.2 mm.; longest 45 mm.; shortest 30 mm.

The following statements are of interest:

1. In comparing the two eyes in emmetropia we find that the distance from the center of the blind spot to the fixation point was a trifle longer, on the average, in the right than in the left eye. This difference is insignificant and the two distances may be considered equal. A variation of more than 2 cm. was present between the longest and shortest distance among all the cases, while the longest distance and the shortest distance were nearly identical in the two eyes; that is, that both eyes presented similar variations and that it was not characteristic of either right or left eyes to show abnormally long or abnormally short distances. In hyperopia the average distance was 3 mm. longer in the left than in the right eye, while the longest and shortest distance was almost the same in each eye. In myopia the cases were so few that the averages may be misleading and a larger number of cases might show different results. The average distance in the left eye was more than 5 mm. greater than in the right eye, and the longest distance as well as the shortest were both found in left eyes. In comparing the distances in the three varieties of refraction we find that the greatest distance was found in myopia as well as the shortest distance. The average distance in emmetropia and hyperopia was almost identical, while in myopia it was fully 5 mm. greater.

2. The center of the blind spot was, with few exceptions, below a horizontal line running through the point of fixation. In hyperopia the distance averaged 10 mm. in the right, and 7 mm. in the left eye, while the greatest distance was 25 mm., and the shortest 2 mm. In myopia the distance averaged 9 mm., the longest 19 mm., and the shortest 5 mm. In emme-

tropia the average was 10 mm., the longest 22 mm., and the shortest 2 mm. These figures show that the center was equally distant from the horizontal line in emmetropia and hyperopia, and was 1 mm. less in myopia.

3. The shape of the blind spot in emmetropia was, with few exceptions, oval, with the long diameter in the vertical or near the vertical axis. The exceptions were six in number; in four the outlines were circular, and in two the long axis was horizontal. This would seem to prove that the optic disc is seldom circular, but in the majority of cases oval, with its long axis vertical, and in a small minority oval, with its long axis horizontal, and that the shape is independent of the refraction.

In emmetropia the long diameter of the blind spot averaged 31 mm., in hyperopia 34 mm., in myopia 38 mm. The longest was in hyperopia and measured 65 mm., the shortest was also in hyperopia and measured 15 mm. In emmetropia the transverse diameter averaged 26 mm., in hyperopia 27 mm., and in myopia 35 mm. The longest was in myopia, 45 mm., and the shortest in hyperopia, 15 mm. From these figures it will be seen that the size of the blind spot was decidedly greater in myopia than in other states of refraction. Very few pairs of eyes showed equal measurement in either the distance of the blind spot from the fixation point or in the position or size of the blind spot, and variations, as great as existed between eyes in different individuals, were found in the eyes of the same individual.

The ophthalmoscopic appearances were noted in all cases examined and only healthy eyes were chosen. Only an approximate estimate in the situation and size of the blind spot could be determined by the ophthalmoscope, except in cases of myopia; here, the size of the blind spot corresponded with the degree of choroidal and retinal changes surrounding the disc, hence with the size and shape of the staphyloma. The practical conclusion that I should deduce from this analysis is that the blind spot has a greater bearing in measurement of the field of vision than has been accorded to it, and might, in the absence of a knowledge of its size, be mistaken for a scotoma of disease. The discovery that a portion of the field measuring 5×4 cm. of irregular outline between the 10°–20° mark in the perimeter and in cases including both is blind, might lead to confusing conclusions as to the real character of the field. Ex-

amination of the eye and shape of the blind spot in cases of optic neuritis, choked discs and glaucoma, would probably be useful in delineating the course of the disease and the value of therapeutics, its increase denoting advance, its decrease, retrogression, of the affection. By carrying on this investigation and including the various types of disease which possibly modify the relations of the blind spot with the field of vision, I hope to arrive at data of diagnostic and therapeutic value.

TRAUMATIC ENOPHTHALMUS.

BY S. C. AYRES, M.D., CINCINNATI, OHIO.

THE rarity of traumatic enophthalmus prompts me to report the following case:

J. E., 35 years of age, a mechanic, gave the following history: Ten months ago he received a severe incised wound in the supraorbital region and almost directly through the eyebrow. The wound was inflicted by a broom-handle which was thrown at him by a shopmate. It was followed by severe swelling of the lids and orbital tissue. For a while it was painful, but later on the inflammation subsided, and as it did so the eye settled deeper into the orbit.

When I first saw him, in August, his eye presented that peculiar appearance resembling an artificial eye. The globe was sunken so that the cornea was 3 mm. deeper than that of the fellow eye. The right palpebral fissure measured 6 mm. in width and the left one 11 mm.

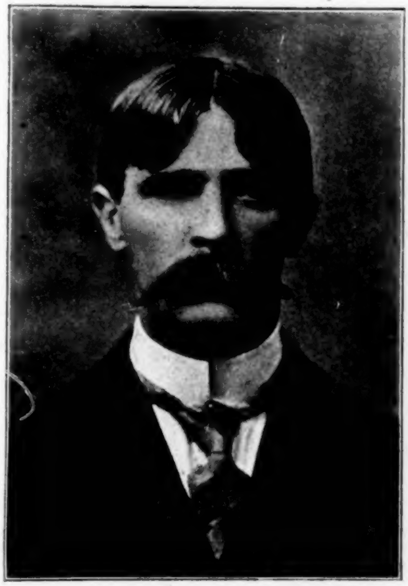
The motility of the eye was curiously involved. Motion inward was unimpaired, outward it was limited, downward it was abolished, and upward it was limited.

The globe was normal in size and tension. There was slight iridodialysis upward with partial rupture of the suspensory ligament and a resulting tremulous iris. The media were clear. The optic disc was pale. V.$={}^{15}/_{CC}$, not improved by glasses. There was no visible rupture of the choroid, nor detachment of the retina.

There was no evidence of any orbital fracture apparent by palpation. Patient stated that he bled from the nose after the injury. This might indicate a slight fracture of the orbital

walls or it might result from the blow, which came with great force.

In this case it would seem probable that the inflammation of the orbital tissue, which followed the injury, was responsible for the abnormal position of the eye. In contrast with this is the case reported by Dr. Schapringer in the *N. Y. Medicinische Wochenschrift*, June, 1890, and quoted by Noyes in the second edition of his book:



A girl, 7 years of age, was struck by her teacher and fell down striking her head on an iron grating. The cornea, it was estimated, had receded about 2 mm., but the functions and movements of the eye were unimproved. In three days the symptoms all disappeared. While these phenomena might be explained by the influence of the sympathetic, yet the case is not parallel with the majority of the cases reported where the trauma was associated with fracture or probable fracture of the orbital walls and where violent orbital inflammation ensued.

Dr. de Schweinitz, in Vol. VII. of the "Transactions of the American Ophthalmological Society," page 386, reports one case of enophthalmus where there was marked impairment of the motions of the ocular muscles on the injured side with dip-

lopia, and yet he thinks the phenomena best explained by a lesion of the sympathetic. He has collected, with his own, twenty-six cases in all.

In Langenbeck's case (a railroad accident) the eye was driven into the antrum of Highmore and finally fixed there.

In von Becker's (Helsingfors) case there was violent fracture of the lachrymal, ethmoid, and superior maxillary bones by the end of the cow's horn.

Gessner's three cases were all traumatic. He says: "The enophthalmos is produced by the mechanical falling back of the globe into the orbital cavity, the contents of which have been reduced by cicatricial contraction of the retrobulbar cellular tissue. An inflammatory participation of the ocular muscles is improbable on account of the absence of disturbances of motility." And yet, in two of his cases there was impairment of motility.

It would seem probable from a study of several of the reported cases, followed by inflammatory symptoms, that the impairment of motility was proportionate to the severity of the injury and the subsequent orbital inflammation. In my case, for instance, the motion of the inferior rectus was entirely and permanently abolished and that of the superior and external recti considerably impaired.

GLAUCOMA IN AN APHAKIAL EYE THREE YEARS AFTER EXTRACTION.*

BY S. D. RISLEY, M.D., PHILADELPHIA, PA.,

ATTENDING SURGEON WILLS EYE HOSPITAL—PROFESSOR DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC AND COLLEGE FOR GRADUATES IN MEDICINE, PHILADELPHIA, PA.

MRS. E., 77 years of age, consulted me in February, 1896, suffering from an over-ripe cataract in the right eye, and failing vision in the left, which proved to be due to incipient cataract. The lens was extracted without iridectomy from the right eye, the operation being perfectly smooth and recov-

*Read before the Ophthalmic Section of the College of Physicians of Philadelphia, October 17, 1899.

ery resulting without accident, leaving a central round pupil without demonstrable adhesions to the remaining capsule or in the region of the wound. On the twentieth day V.=$^6/_{IX}$.

Six months later she returned from her home in the interior with vision reduced to $^6/_{XL}$ by a dense opaque capsule. After a secondary operation, which resulted in a clear black pupil, vision rose to $^6/_V$, and remained at this, with perfectly satisfactory use of her eye until February, 1899, three years after the primary extraction, when she suffered a very severe attack of influenza, which permanently impaired her health, and was attended by a red and painful eye.

In March she began to have transient attacks of dim vision during which she was unable to read. They were unattended by pain and were often but momentary in duration, but at other times would last an hour or more.

These attacks of impaired vision became more frequent and severe until, on the 23rd of April, they culminated in a typical onset of subacute inflammatory glaucoma, with pain and seriously impaired vision.

She then came to Philadelphia, and after a long journey by rail was so nearly blind from contraction of the field of vision, that she had to be led to a chair in the consulting room. Central vision was $^1/_V$ with difficulty, T+2; the cornea was steamy, there was some tenderness to palpation and a moderate degree of ciliary injection. She had suffered from pain in the ball and a severe hemicrania for three days. The pupil was round, central, and 3 mm., in diameter, but was firmly adherent to the dense gray capsule by an apparently annular synechia. The lower part of the anterior chamber was of normal depth but the upper and inner two-fifths of the iris were bulging forward, quite blocking the spaces of Fontana in that portion of the angle.

Iridectomy was advised and she was admitted to a private room in the Polyclinic Hospital, placed on salicylate of soda, internally, with eserine and gentle massage locally. In twenty-four hours the symptoms had so rapidly and completely subsided that iridectomy was deferred.

In a few days the iris bombée had disappeared, T=n, there was no pain or injection, and vision had risen to $^6/_{XII}$, while the field was approximately normal. She was then discharged from the hospital but kept under observation. The eye remained

healthy, with the single exception of a momentary attack of dim vision in June, until the latter part of August, when she suffered a complete recurrence of all the symptoms, subjective and objective.

She was again admitted to the hospital and an iridectomy upward performed on September 9th. The recovery was without reaction.

On September 29th, T=n, vision was once more $^6/_{IX}$, the field was again nearly restored, and the eye comfortable. The ophthalmoscope now revealed a shallow glaucomatous cup, which was not present after the attack in April.

It is obvious that this case belongs in the category of secondary glaucoma. The recurring attacks of dim vision were doubtless precipitated by the gluing of the iris to the tough capsule which retracted after the capsulotomy into an unusually dense ring.

A NEW STATIONARY OPHTHALMOSCOPE WITHOUT REFLEXES.

BY WALTER THORNER, M.D.

TRANSLATED BY CARL BARCK, M.D., ST. LOUIS, MO.

Introductory Remarks by the Translator.

THE most interesting new instrument by far, in fact the only one of value exhibited at the last International Congress at Utrecht, was Thorner's Stationary Ophthalmoscope. A practical demonstration of its use was given each morning at the New Eye Clinic, which was highly appreciated by everyone present. Whilst surpassing any other ophthalmoscope in the combination of a large field of view with brightness of illumination, the most important feature is the elimination of all the reflexes; consequently it is especially the examination of the macula lutea region which will be facilitated by the new instrument, and it is to be hoped that it will shed new light on many of the still obscure macular affections. I must confess that never before have I seen the macula lutea region of the adult with such beautiful clearness.

The time was naturally too limited, each awaiting his turn, to admit of any more exhaustive examination, but was sufficient to justify the statement that the instrument fulfills perfectly all the inventor claims for it.

The optical considerations which led the inventor to the construction of his ophthalmoscope seemed to me of sufficient interest to the profession to translate the entire article which appeared in the *Zeitschrift f. Psychologie und Physiologie der Sinnes-Organe*, Vol. XX.

Since the invention of the ophthalmoscope by Hermann von Helmholtz, in 1851, numerous modifications have been proposed. Of all the different methods of examination, however, only two have proven to be of practical value:

1. The examination with a perforated plane or concave mirror, either unaided by optical adjuncts, or aided only by correcting glasses for the different states of refraction, adjusted behind the mirror.

2. The examination with a perforated concave mirror, aided by a convex lens of 5 to 10 cm. focal distance, which forms an inverted image of the fundus oculi.

The proposed changes concern first the mirror. Apart from the reflecting glass-plate, used by Helmholtz himself, there have been suggested plane, concave and convex mirrors of all possible diameters and radii of curvature, with apertures of different position and size, and prisms of total reflection with plane or curved surfaces. The second variety of adopted changes applies to the optical adjuncts, and it was again Helmholtz who first endeavored to examine the fundus through two convex lenses arranged according to the principles of the telescope. He emphasizes theoretically the analogy with other optical instruments, and the easy adjustment for different states of refraction by changing the distance of the lenses from each other. As a disadvantage, he mentions the necessity of centering them, the difficulty of the proper accommodation of the observed eye, and, finally, that he could not get a distinct picture on account of the short focus of the lenses, necessary to the magnification of the field of view. According to the same principle numerous apparatuses have been constructed afterwards, but they have never equalled the other two methods of examination in practical value.

There are principally two reasons for this: If the lenses are placed betwen the mirror and the eye of the patient, the reflexes in the lenses and the enlarged corneal reflex are disturbing to such a degree, that an examination becomes next to impossible. If, on the other hand, the lenses are set behind the mirror, the corneal reflex is still very annoying. Furthermore, the aperture in the mirror forms a diaphragm, in consequence of which there is no perceptible advantage in regard to the field.

Lately[1] I have constructed an ophthalmoscope which gives a field of view of 37° in the magnitude of the upright image, and which is totally free from annoying reflexes.

Before explaining its construction I shall enumerate the general laws which led me to the calculation of this ophthalmoscope, in a synopsis which seems to me most comprehensive and best adapted for use. I shall not enter into the proof of the formulæ, as they are resultant from well-known laws, which are contained partly in "Helmholtz's Text-Book of Physiological Optics."

THE REFLEXES.

There is one main cause why the principles for the construction of other optical instruments could not be applied to the ophthalmoscope. The light, of necessity returning from the observed eye to the observer in the same path which it took from the source of light, is partially reflected at its entrance into every new medium, and in such a manner that these reflected rays are mingled with those coming from the fundus. This is least noticeable if only a small portion of the fundus is under observation; it becomes more annoying the larger the area to be illuminated; in an extensive field the entire picture is covered by a haze.

Up to date, only one device has been frequently used to dispose of the reflexes. The eye is surrounded with a closely-fitting box filled with a physiological salt solution, which is closed in front with a plane glass-plate. Because the salt solution has about the same index of refraction as the human cornea, the incident rays of light are not reflected at the cor-

[1]Preliminary communication in the *Deutsche Medicinal-Zeitung*, No. 98, December 8, 1898.

nea. I have made no experiments with this method because it appeared to me *a priori* too cumbersome for practical use.

A second possibility to dispose of the reflexes is given in the use of polarized light, which had already been tried by Helmholtz during the construction of his first ophthalmoscope, in order to weaken somewhat the reflexes. If the light reflected from the retina possesses qualities differing from those of the light reflected from the cornea, both kinds of light might be made to pass through an apparatus which would neutralize the rays reflected by the cornea but allow those reflected by the retina to pass. One's first thought might be that the light reflected by the cornea is already linear-polarized; but this is the case only for a given angle of reflection. If the corneal reflex produced by illumination with a circular luminous area is viewed through a Nicol's prism, only portions of it become totally extinguished—namely, those which are reflected just in the angle of polarization for the cornea. In general, the reflex is only more or less diminished in intensity. In order to obliterate it entirely, it is necessary to illuminate the eye by linear-polarized light. This will be reflected from the cornea as linear-polarized, but from the fundus as depolarized light. If then, the totality of the rays is viewed through a Nicol's prism, whose plane of polarization forms an angle of 90° with the plane of the incident light, the corneal reflex becomes extinguished, whilst the depolarized light coming from the fundus becomes again linear-polarized and, therefore, reaches the eye of the observer. In the same manner as the corneal reflex disappears by this arrangement, the reflexes of one or more interposed lenses disappear likewise.

I have made numerous experiments applying this principle, the results of which I will now mention. At first, I used Helmholtz's arrangement, namely, a glass-plate, serving simultaneously as polarizer and illuminating mirror, the perpendicular of which formed an angle of 55° with the axis of observation and with the direction of the incident light. If a number of such glass-plates are placed, one behind the other, the same scheme can also be used as analyser, because only such light is transmitted whose plane of polarization forms an angle of 90° with the plane of the light reflected from the glass-plates. But by this method the reflex is far from becoming entirely obliterated. Furthermore, there is only a given

angle of reflexion, at which the reflected light is really linear-polarized. For the illumination of a larger area, however, the rays of light necessarily reach the eye in different directions, and, therefore, the angle of many of the reflected rays differs considerably from the angle of polarization.

The aim is attained much better if Nicol's prisms, whose planes of polarization form a right angle with each other, are used as polarizers as well as analyzers. With this arrangement the principle of the ophthalmoscope may be combined in many various ways. The simplest, theoretically, seems to be the use of only one Nicol's prism, the path of the extraordinary ray serving for observation, whilst the ordinary ray is not absorbed, as usual, at the wall, but passes through and reaches the source of light. I have accomplished this by cementing one side of a right-angled prism, whose other side was silvered, to the polished wall of the Nicol.

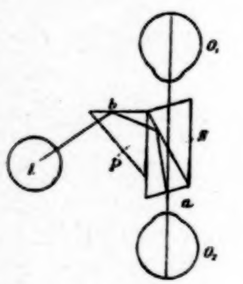


FIG. 1.

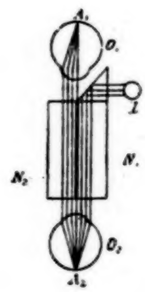


FIG. 2.

In figure 1, O_1 represents the eye of the observer, O_2 the eye observed. From the source *L*, the light reaches the hypothenuse of the right-angled prism *P* about vertically, is reflected from the silvered side *b*, and enters through the other side, the Nicol *N*. There it is totally reflected at the plane of bisection, reaches the point *a*, and makes its exit through the anterior surface toward the eye, O_2. Of the rays of light returning from O_2, those belonging to the corneal reflex, being in the same plane with the incident rays, return to the source of light, whilst the depolarized rays, coming from the fundus, reach partially, by way of the extraordinary rays, the eye O_1. In this scheme, however, the diffuse reflexes which are formed within the Nicol, are of great disadvantage, so that the picture of the fundus is considerably blurred.

This may be avoided if, instead of one, two Nicols are used, which are fastened closely to each other in such a manner that their planes of polarization are at right angles. Whilst the light enters the one by reflection from the hypothenuse of a right-angled prism, the other serves for observations. This arrangement produces a fairly good image without reflexes, but the field of view is small on account of the tubular form of the Nicols, because a given point of the fundus can be seen only, if rays emitted from it traverse both Nicols, to the light as well as to the observer.

In figure 2, O_2 represents again the observed eye, O_1 the eye of the observer. From the point A_2 of the fundus of O_2 one half of the rays passes through the Nicol N_1 to the source of light, a small lamp L, and *vice versa*, the other half passes through the Nicol N_2 to the eye O_1 producing an image of A_2 at A_1.

Based upon the principle of polarization, I have found the following arrangement to be the most practical:

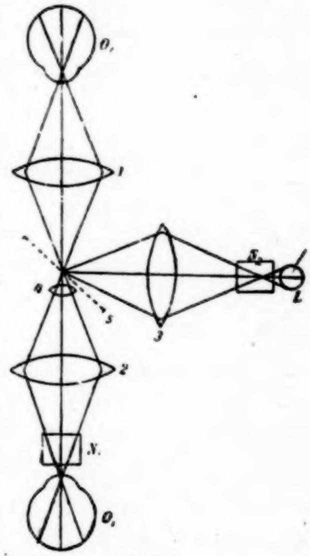


FIG. 3.

Between the eye O_1 (observer) (Fig. 3) and O_2 there is a plane mirror S, inclined at an angle of 45°. The coating of this is broken, lattice-like, the strips being 1 mm. wide, and a like distance apart from each other. The convex lenses, 1, 2, 3, are all of the same focal distance and are arranged in such a manner that the pupils of O_1 and O_2 and the flame L are simultaneously pictured upon the mirror S. As the Nicol N_1 is placed closely in front of the pupil of O_1, and N_2 closely in front of the flame L, neither the Nicols nor the pupils of the eyes act as diaphragms.

In order to get a distinct picture of the fundus, it is necessary to place the convex lens 4 behind the mirror. The lines in the drawing represent the rays which limit the field of view. The image of the flame L formed by lens 3 in the plane of the mirror is re-formed by the lens 1 in the pupillary area of O_2

and, consequently, a large area of the fundus is illuminated. The plane of oscillation of the rays polarized by Nicol N_1 is at right angles to the plane of light passing N_2. Although the linear-polarized light becomes elliptically polarized through the reflection from the mirror, the difference is such a trivial one in the given position of the mirror that the reflexes disappear entirely.

By this arrangement it is therefore most clearly demonstrated that with the aid of polarization of the light, it is really possible to dispose of the reflexes from the cornea as well as from the interposed lenses. In spite of this, I have abandoned the use of polarization, because the Nicol's prisms diminish considerably the already weak light reflected from the fundus, and because the same end, elimination of the reflexes, can be accomplished in a much more simple manner.

Suppose a dividing plane be drawn in such a manner that it reaches the center of the cornea of the observed eye, and suppose that light is thrown through one half of the pupil whilst the other half serves for observation, it is apparent that there can be no reflexes. Up to the cornea the system of illumination and the system of observation are entirely separate, thence the pencils which pass each half of the pupil mingle until they become united upon the fundus. But such a separation of the systems of illumination and observation is practically impossible, because a real partition dare not touch the cornea.

If it does not reach the cornea, if a space of a few millimeters only is left, so many pencils are reflected from the system of illumination to the system of observation that no observation is possible. This missing portion, however, of the real partition can be substituted optically by the image of such.

First, suppose, for simplicity's sake, that the eye O_2 (Fig. 4) is illuminated by a reflecting glass plate *g g*. In order to illuminate the largest possible area of the fundus, let an image of the flame *L* situated at double the focal distance from a convex lens *A*, of large aperture, be produced within the pupil of O_2. Consequently this image is of the same size as *L* itself. The fundus is observed in the inverted image by means of a lens *B* of 25 cm. focal length, placed in the center between the observer O_1 and the observed O_2, and at a distance of 50

cm. from each. An image of the fundus is then formed between B and O_1 at a convenient accomodative distance. Now let one-half of L be covered by a diaphragm s s. Then an image of s s will be formed within the half-pupil O_2, b c, that is, this half becomes darkened, whilst the other half, a b remains illuminated. In the fundus, however, of the eye O_2 the same area as before remains illuminated, but with half the intensity. The non-illuminated half of the pupil b c is pictured within the half-pupil of O_1 e f, whilst the illuminated half is pictured within d e. All rays, therefore, which are reflected from the illuminated portion of the cornea of O_2 possess the same qualities as if a b itself were luminous, and the pencil is propagated to e d, whilst no ray of this reflex can fall upon the area e f.

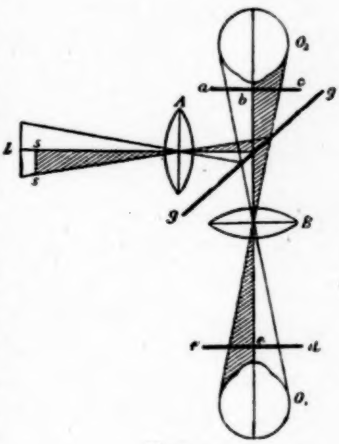


FIG. 4.

If now there is another diaphragm placed before d e, the corneal reflex is entirely obliterated, and only light reflected from the fundus enters the eye of the observer O_1. The size of the visible area is not diminished by this diaphragm, but the intensity of the illumination is reduced to one half.

In the figure the hatched portion represents the pencil, which is composed exclusively of rays coming from the fundus of O_2, whilst in the unhatched portion, the rays coming from the fundus are mingled with those reflected from the cornea. For practical reasons it is not advisable to use a glass-plate for reflection; first, because it reflects only a small portion of the incident light, thereby necessitating a very strong flame; second, because if brightly illuminated, it diffuses the light in all directions, which interferes with the clearness of the image. It is, therefore, better to replace it by a totally reflecting prism, which, being non-transparent, must cover only one half of the pupil of O_2.

FIELD OF VIEW AND MAGNIFICATION.

Having accomplished the elimination of the reflexes by this method, let us consider the conditions under which the largest possible field of view can be seen most highly magnified and illuminated. To simplify matters, we suppose that the eyes of the observer and the observed are emmetropic. I will, furthermore, not take into consideration the loss of light through reflection and absorption by the different lenses, as it is of slight importance and would only complicate the subject.

If, to begin with, we assume the fundus to be self-luminous, a divergent pencil of rays is emitted from every point of it, the basis of which is given by the pupillary edge of the iris. By refraction at the different refracting surfaces this divergent pencil is changed into a pencil of parallel rays, so that the point from which it emanates lies apparently at an infinite distance.

In order to conceive the laws governing the enlargement and the field of view, the following apparatus may be imagined: In a darkened window there is a circular opening of about 8 mm. diameter—the size of the dilated pupil. Then the pencils of rays, coming from visible objects, such as houses outside, form similar pencils like those coming from the fundus after they have left the eye. In reality the pencils are divergent, but at so minute an angle that in this illustration we may consider them as parallel. Consequently, the path of the rays between the observer and the window corresponds to that between the observer and the iris of the observed eye, whilst, on the outer side of the window, this is not the case. If now, in this example, the street is viewed unaided by lenses corresponding to the examination in the upright image, a distinct image is seen when the eye of the observer is accommodated for an infinite distance. This image is neither magnified nor diminished. We will term its size the "natural angular magnitude." To this natural angular magnitude corresponds the magnification of the upright image, which we might term likewise the "natural angular magnitude of the fundus." For the time being it is unnecessary to determine the ratio of magnification of this upright image to the actual size of the fundus seen after removal of the anterior half of the globe.

The extent of the visible area depends upon the distance

of the observer from the aperture in the window. The shorter the distance the larger the area, and if the observer could approach so closely that his iris would coincide with the aperture, the field would be unlimited. If the pupil of the observer and the aperture in the window are centered, the middle of the field of view appears most brilliant, the brightness decreasing toward the periphery. The size of the field can be expressed in a very simple formula if we consider it only up to those points, the brightness of which is one half of the brightness at the center. Peripherally to these points the brightness of the field decreases so rapidly that we can neglect this most extreme portion.

On close approach of the observer the principal rays emanating from these points strike the edge of the aperture in the window. In consequence the tangent of half of the visual angle is equal to the radius of the aperture divided by the distance of the anterior nodal point of the observing eye from it. For the latter we can substitute, without any considerable error, the distance of the plane of the iris from the aperture. Instead of expressing the field of view by an angle, it is more practical to express it by a fraction, whose numerator is the diameter of the aperture and whose denominator is the distance between it and the iris of the observer, that is, the double tangent of half of the visual angle. As it is impossible, in the usual examination with the upright image, to approach the human eye closer than 5 cm. on account of the apparatus for illumination, the field of view can never be larger than $^{8}/_{50}$ = about $^{1}/_{6}$, or, expressed by the angle, 9°. This field, however, can not be seen in its entirety, because only a portion of it is illuminated at a time, but by revolving the mirror the single points may be illuminated one after the other.

The conditions are different if an optical system is interposed between the aperture in the window and the eye. Let us consider first the use of a single convex lens. In order that the aperture in the window does not act as a diaphragm, an image of it must be formed upon the plane of the iris of the observer. The field of view is then limited by the rim of the lens and its extent is expressed by the formula:

$$\frac{\text{Diameter of convex lens.}}{\text{Distance of lens from iris.}}$$

The ratio of the angular magnification to the natural angular

magnitude is then equal to the diameter of the aperture divided by the diameter of the image formed by the lens within the pupil of the observer. Consequently objects on the street appear in natural size if the image of the aperture produced by the lens upon the iris-plane is just as large as the aperture itself. They are apparently diminished in size when the image is larger, and magnified when the image is smaller than the aperture. The eye must be held at such a distance from the convex lens that the picture of the street, which is formed at the focus of the lens, can be seen distinctly. The accommodation required does not materially alter the size of the image upon the retina of the observer but it produces the sensation of an apparent diminution.

Let us now apply these considerations to the observation in the inverted image. The convex lens commonly used for this purpose has a diameter of 30 mm. and a focal distance of 75 mm. In order to see distinctly the usual distance of the eye from the aerial image is about 225 mm., therefore from the lens itself 300 mm. = 4 f. (focal distance). The iris of the observer is then pictured by the lens at a distance of $^4/_3$ f. = 100 mm., and consequently reduced linearly to $^1/_3$. The iris of the observed must occupy this position in order not to act as a diaphragm. Consequently the image possesses $^1/_3$ of the natural angular magnitude or $^1/_3$ the size of the upright image. The field of view is $^{30}/_{300} = {}^1/_{10}$, and in angles 6°. But as in this field all parts appear only $^1/_3$ as large as in the upright image, it actually corresponds to an area of $^3/_{10}$ of the fundus.

If it is now desired to attain the magnification of the upright image and at the same time a larger field of view than $^1/_6$, this can be accomplished only by the interposition of an optical system which pictures the pupil of the observed in its natural size within the pupil of the observer. If *one* convex lens is used for this purpose, it must be placed midway between the two pupils, distant 2 f. from each; and its focal distance must be such that the aerial image is distinctly visible without strained accommodation, else an additional convex lens directly in front of the eye must be added. The largest lens which can possibly be used in this arrangement has a diameter of $^1/_2$ f. In this instance the field of view is:

$$\frac{\text{Diameter of lens}}{\text{Distance of lens from the eye}} = {}^{75}/_2 : 150 = {}^1/_4.$$

Consequently a slight advantage is gained in comparison to the observation without a lens. A decided enlargement of the field of view can be obtained by the use of *two* convex lenses of equal focal distance. They are arranged in such a manner that the pupil of the observed lies in the anterior focus of the one, the pupil of the observer in the posterior focus of the other, and their distance from each other is 2 f., thus forming a telescopic system.

FIG. 5.

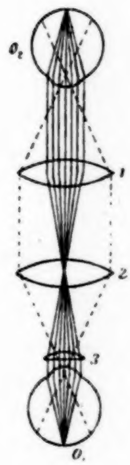


FIG. 6.

In Fig. 5 the dotted lines represent those principal rays which form the limits of the field. The unbroken lines represent the path of the pencil emitted from one point of the fundus. It is apparent that the field is limited only by the rim of the lenses and that the principal rays between the two lenses run parallel. In consequence a change of the relative distance of the two lenses has no influence upon the size of the field of view and the angular magnification, provided that the distance of the pupil of each eye from its respective lens remains the same; it is only the position of the image which is changed thereby. The field of view then becomes equal in size to the diameter of the convex lenses. If both eyes are emmetropic and the accommodation is relaxed, the observer sees a distinct image if the distance between the two lenses equals 2 f. But

this scheme possesses the disadvantage that the picture is very chromatic and that its periphery is not sharply defined, because the plane of the image is too much curved. These drawbacks can be eliminated if the convex lenses are brought nearer to each other, so that their relative distance becomes equal to 1 f., the distance of each eye from its respective lens remaining unaltered. The image is then formed at the place of the lens 2 (Fig. 6) next to the observer, and in order to see distinctly the observer must use a third convex lens (3) of the same focal distance which is placed closely before his eye. This management renders the image nearly achromatic and equally distinct in its entire area. A slight curvature of the image towards the observer remains, but this is advantageous for our purpose, as the retina of the observed eye is considerably curved in the opposite direction and these two curvatures compensate each other.

If anomalies of refraction are present their correction can be accomplished easily by changing the distance between the lenses 1 and 2 within certain limits; for the highest degree of hyperopia and myopia the lens 3 is replaced by a relatively stronger or weaker one.

The diameter of the lenses 1 and 2 can be increased to $^2/_3$ f. without obscuring the image. The field is consequently also $^2/_3$ or $= 37°$. In addition to the three-fold linear enlargement it is also five times as large in superficies as the field of the inverted image with the usual three-inch lens which embraces only $^3/_{10}$ of the fundus. It can be proved by calculation that this system of lenses *in toto* is movable between the two eyes in the direction of the axis without changing the magnification or field of view, provided that the distance between the two pupils $= 3$ f., and the relative distance between the three lenses remains constant; only the diameter of lens 3 is to be increased if the lens is removed from the eye. The system can therefore be placed in any position within certain limits. If we compare it to an astronomical telescope the convex lens 1 corresponds to the objective, lens 2 to the collective lens, and lens 3 to the ocular. It differs from the telescope in so far that the objective and the collective lens possess very large diameters and that the image of the objects is not magnified but seen in natural angular magnitude.

As a matter of course the field can only be seen in its en-

tirety if illuminated in its entire area. It is, therefore, necessary to use for illumination a system similar to that for observation, and the above outlined principle of the diaphragm, which produces an image without reflexes, can be easily combined with such a system.

THE BRIGHTNESS OF THE OPHTHALMOSCOPIC PICTURE.

The next question to be investigated has reference to the brightness of the ophthalmoscopic picture. This can be calculated from the following laws:

1. A given point of the observed fundus can be seen by the observer under the condition only that a portion of the rays, emitted by it, reach the source of light and another portion the pupil of the observer.

2. A given point of the observed fundus is illuminated maximally, if all the rays which it would emit, if self-luminous, reach the flame. The degree of illumination is then in proporrion to the size of the pupil.

3. The observed fundus is seen illuminated maximally by the observer, if all the rays which a point of the fundus of the observer would emit, if self-luminous, reach the pupil of the observed. The brightness is then proportionate to the size of the pupil of the observer.

The third proposition is resultant from the second, if the flame is replaced by the fundus of the observed, and the observed eye by the observer.

Let us take for example: From a given point of the fundus a pencil of rays emanates which leaves the eye as a parallel pencil. The diameter of this pencil is equal to the diameter of the pupil. If now there is anywhere in the path of this pencil an evenly-luminous flame of larger size than the pupil, all rays of this pencil meet a portion of the flame, and simultaneously rays emitted from these points of the flame reach the respective points of the fundus. As the pencil is of the same diameter throughout, the distance of the source of light is immaterial. At all times all the rays emanating from the given point of the fundus reach portions of the flame and therefore the illumination does not change with the distance as long as finite relations are under consideration. If a system of lenses is interposed between the eye and the flame, the rays emanating from one point form no longer a parallel pencil, but a cone,

whose diameter is a different one at each transverse section. If, now, the flame is placed in the path of such a cone, the given point will be illuminated as brightly as before, provided that the flame covers the entire face of the section. If the flame is situated near the apex of the cone, it can be very small; if at a section of a larger diameter, it must be correspondingly large.

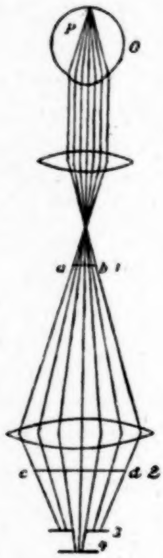


FIG. 7.

In Fig. 7, it is immaterial whether the flame is placed in the position 1 and has the size of *a b*, or in the position 2 with the size *c d*. But if a diaphragm is placed anywhere, for instance at 3, the flame occupying the position 4, the degree of illumination of the point *p* is only a part of the maximal one; their proportion is the same as that of the aperture in the diaphragm to the section of the pencil at 3. Let us apply this consideration to the ophthalmoscope: We will calculate only the degree of brightness for the points situated in the center of the field of view and assume a flame of nearly uniform intensity like a petroleum or gas flame.

In the examination with the upright image, the pencil of parallel rays coming from a point of the observed fundus is reflected by the common plane mirror to the source of light and its transverse section is not changed. Consequently all rays reach a portion of the flame and the point will be illuminated maximally. But the mirror itself acts as a diaphragm because the aperture does not reflect. Let the dilated pupil have a diameter of 8 mm. Then the maximal illumination can be expressed simply by the square contents of the pupil in sq. mm. It is then $= 4^2 \pi = 16 \pi$. If the aperture of the mirror has a diameter of 4 mm., one-fourth part of the pencil in the plane of the mirror is not reflected and the illumination is consequently three-fourths of the maximal $= 12 \pi$. All rays emanating from a point of the fundus of the observer reach the pupil of the observed, because this pencil has only a diameter of 4 mm., and the pupil of the observed one of 8 mm.; therefore the fundus is seen with maximal brightness. This brightness can also be expressed by the square contents of the aperture in the mirror;

it is $= 2^2 \pi = 4 \pi$. By multiplying this constant with the one found for the illumination, we get as total resultant for the brightness of the upright image $48 \pi^2$.

In considering the inverted image we will assume the same constants as above: Diameter of the dilated pupil : 8 mm., convex lens of 30 mm. diameter and 75 mm. focal distance, distance of pupil of the observed eye from lens : $^4/_3$ f., distance of lens from eye of observer : 4 f., diameter of aperture in mirror : 4 mm., focus of mirror : 150 mm. Then the pencil emanating from a given point at the fundus of the observed eye has a diameter of 8 mm. in the plane of the lens, and one of 24 mm. in the plane of the mirror. From this point to the flame the transverse section again decreases, so that all its rays reach portions of the flame. The diaphragm occupies in this instance only $^1/_{36}$ of the transverse section, the illumination is therefore $^{35}/_{36}$ of the maximal one, or $= {}^{35}/_{36} \times 16 \pi = 15.6 \pi$. The pencil of the rays coming from one point of the fundus of the observer has again a diameter of 4 mm., in the plane of the pupil of the observed $^4/_3$ mm. and consequently enters it entire. The fundus is therefore seen with the maximal brightness 4π. The product: $15.6 \pi \times 4 \pi = 62.4 \pi^2$ expresses the brightness of the inverted image, which is considerably greater than the brightness of the upright image.

[TO BE CONCLUDED].

BETA-EUCAIN AS AN ANÆSTHETIC.—In a paper on Beta-Eucain as an anæsthetic in eye, nose and throat work, published in the *Medical News*, Dr. W. H. Poole reaches the following conclusions:

1. Beta-Eucain is decidedly less toxic than cocain, therefore superior to it.

2. Its aqueous solutions keep well and can be sterilized by boiling without destroying the activity of the drug.

3. It produces anæsthesia equally as well and sometimes better than cocain.

4. It is superior to cocain in that it does not cause heart depression or other unpleasant effects.

5. It does not cause mydriasis or disturbances of accommodation, which is an advantage in some cases.

6. It is less dangerous to the cornea than cocain, inasmuch as it does not cause desquamation of the superficial epithelium.

MEDICAL SOCIETIES.

A DISCUSSION ON THE PATHOLOGICAL SIGNIFICANCE OF SYMPATHETIC IRRITATION, AND ITS CONNECTION, IF ANY, WITH SYMPATHETIC OPHTHALMITIS.

HELD IN THE SECTION OF OPHTHALMOLOGY OF THE BRITISH MEDICAL ASSOCIATION AT ITS SIXTY-SEVENTH ANNUAL MEETING.

[CONCLUDED FROM PAGE 319, OCTOBER NUMBER.]

II.—PROFESSOR LANDOLT,

Paris.

PROFESSOR LANDOLT quite agreed with Mr. Cross' conclusions. A lost eye which might become a danger to the fellow eye should be removed. If he had made this statement some twenty or thirty years ago it would have seemed superfluous, since everybody would have agreed with this principle. But since then many proposals had been made to save the healthy eye without enucleation of the damaged eye, such as resection of the optic nerve, of the ciliary nerves, subconjunctival injections of antiseptics, etc. He had never followed any of these procedures, but a short time ago he had the opportunity of seeing a case in which, after the penetration of one eye by a foreign body, notwithstanding subconjunctival injections of sublimate, both eyes followed the ordinary course—that is to say, the first became very severely inflamed, and gradually shrank, whilst the other non-wounded eye manifested the symptoms of sympathetic ophthalmitis in a pronounced degree. The removal of the shrinking eye, in which a foreign body was subsequently found, stopped the further development of the sympathetic ophthalmia in the other.

III.—Malcolm M. McHardy, F.R.C.S.Edin.,

Professor of Ophthalmology, King's College, London.

Mr. McHardy said: It is satisfactory to recognize that this company of highly experienced ophthalmic surgeons, sitting under our distinguished President, who has such unsurpassed, if not indeed unparalleled, experience in cases of eye injury, are agreed on one point—namely, as to the direct duty of recommending and urging the prompt removal of an eye blinded by injury. They say the rule is for doctors to differ; maybe oculists do so also; but whether that be the rule or no, it is proved by the exception that we are not differing, but agree as to the treatment for a pathological chain of events, which we recognize we have not yet satisfactorily disentangled. Our opinion and advice may, it seems, be briefly and comprehensively summed up in the speech I have to repeat only too often, but happily seldom or never without carrying the desired conviction to the patient: "My friend, you know that no tenant is better than a bad tenant; I know that your injured eye is the worst tenant you could have. It was an eye while it could see; now it can not, and will not again see; it may at any moment cause the gravest danger to the sight of your only remaining organ of sight. It is good business to cut a first loss at once; part with that injured bad tenant, and have peace of mind as to the security of your only seeing eye." This reminds me of the excellent counsel of that Nestor of English ophthalmologists, our revered Sir William Bowman. He said, "In such cases as those in which you are bound to recommend enucleation of the injured eye for the insurance of the fellow, you should urge the enucleation, but you should be careful never to proclaim it as necessary to the salvation of the sight of the fellow eye. The period which may elapse between injury of the exciting eye and inflammation of the sympathizing eye is so variable, even from three weeks to forty years, and if the precaution named be omitted, each year of such postponement tends to damage the patient's estimate of the oculist." I have never eviscerated; and I gather that none of us here, with our special experience, would in our own person allow delay, or any substitute for enucleation, to postpone our certain relief, by enucleation of the injured eye, from our well-grounded nightmare, that, at a future date, sympathetic ophthalmia might overtake our working eye.

IV.—Henry Caley, F.R.C.S.,

Deputy Surgeon-General, I.M.S. (Retired).

Surgeon-General Caley said a case of sympathetic irritation, the symptoms progressing to sympathetic inflammation in one eye, came under his notice in the person of a member of the Public Works Service in India, who seventeen years previously had been shot in the other eye. It was not known whether the shot was lodged in the globe. The injury was followed by inflammation and gradual loss of sight, only bare perception remaining. After this interval of seventeen years the injured eye became sensitive and slightly inflamed. This was soon followed by sympathetic irritation, with symptoms of pain, tenderness, and congestion in the good eye. He removed the injured eye and found a shot lodged in it. The irritation of the sound eye quickly subsided and did not return, and good sight remained. This attack must, he thought, have been due to some neurotic influence, and not due to direct microbic or other inflammation spreading from the injured eye.

V.—C. Devereux Marshall, F.R.C.S.,

Curator and Librarian, Royal London Ophthalmic Hospital, Moorfields.

Mr. Marshall said: I am sorry not to have been able to bring forward as much evidence on this subject as I should have wished, but I found it impossible owing to want of time. With regard to the two theories which are held, I have always seen great difficulty in accepting that of Deutschmann. If sympathetic ophthalmitis were the result of micro-organisms traveling around to the healthy eye from the injured by way of the optic nerves, we should certainly expect to find the disease most marked in those cases where the eye was most surrounded with organisms such as in cases of panophthalmitis and gonorrhæal ophthalmitis. As a matter of fact, it is just these cases which do not produce the disease, but the comparatively quiet cases in which there is an injury to the iris or ciliary region. Again, some of Deutschmann's animals did certainly show signs of disease in the other eye after the injection of organisms into the optic nerve sheaths, but only if they escaped the danger of general infection or of meningitis, of which many died. No one ever heard of a patient having an eye likely to produce sympathetic disease suffering in this

way. Again, it is a cyclitis rather than an optic neuritis which we look for. Organisms are said to have been found in the optic nerve and in the ciliary body of the sympathizing eye, but the evidence of this requires confirmation before it can be thoroughly accepted. I am much interested in Mr. Cross' suggestion that a combination of the two theories may explain some facts which neither alone are capable of doing.

VI.—Professor G. E. de Schweinitz, M.D.,

Philadelphia.

Professor de Schweinitz said that he agreed with the views expressed by Mr. Cross and Dr. Landolt as to the treatment of an eye liable to excite ophthalmitis. He maintained that although there might be cases in which it was impossible sharply to differentiate between sympathetic ophthalmitis and sympathetic irritation, these two affections should be regarded as separate diseases, each with its own pathology. He concluded with a plea for a more thorough examination of patients with sympathetic ophthalmitis, an examination of the blood for leucocytosis, of the range of temperature, etc., and suggested that such examinations might afford materials for differential diagnosis.

VII.—R. A. Reeve, M.D.,

Professor of Ophthalmology and Otology, University of Toronto.

Dr. Reeve said: In a case of sympathetic irritation in which distinct photophobia had been present for fifteen years, necessitating the wearing of smoked lenses, and in which the lost eye was much congested and very irritable, the cataractous lens spontaneously dislocated, and recurrent hæmophthalmos occurred. Mules' evisceration was followed in a few weeks' time by complete disappearance of the photophobia. In the only two cases of sympathetic ophthalmitis (iritis) under my care which have recovered, enucleation was done. This is to me a significant fact. In the first instance, fully twenty-five years ago, the inflammation of the second eye did not appear until several weeks after enucleation. Atropine and local depletion, with the internal exhibition of mercury, were pushed and full recovery ensued. In the second case the patient was suffering from the abuse of alcohol, and the sympathetic inflam-

mation was fully set up in three weeks after injury to the exciter. Prompt enucleation in conjnnction with atropine, mercury, etc., resulted in full recovery.

VIII.—Adolph Bronner, M.D.,

Surgeon, Bradford Eye and Ear Hospital.

Dr. Bronner had seen and reported on a case of sympathetic ophthalmia in which there was no external wound of the injured eye. The patient, a woman, received a blow from the fist on the eye. There was discoloration of the lens, hæmorrhage into the vitreous, but no external wound, as proved by microscopical examination. In three weeks sympathetic ophthalmia of the second eye set in. The chief symptoms were keratitis punctata and papillitis. The injured eye was enucleated, and the vision of the sympathizing eye improved up to $^6/_{\text{XVIII}}$.

IX.—John Hern, M.D.,

Ophthalmic Surgeon, and Surgeon, Darlington Hospital.

Dr. Hern said: There can, I think, be no doubt that we have, as Mr. Cross says, two conditions—one a reflex neurosis, the other some condition of inflammation (microbic or otherwise) traveling back, and invading by continuity the good eye. I have seen two interesting cases bearing on this question of reflex neurosis. Both were men, both otherwise healthy, and both had a shrunken stump. In the first case I could produce an attack of sympathetic irritation by placing a glass eye on the stump. I removed the stump, and the eye is now worn with comfort and without any irritation. In the second case every now and then attacks of inflammation occurred in the good eye, which did not go on to injury of the sight or to the destructive cyclitis usually experienced, but the interesting point is that symptoms of cerebral and general nervous irritation were constant, so much so that his wife refused to live with him. The stump was removed, the remaining eye has never since been inflamed, and the general and cerebral irritation has entirely disappeared now for at least three years.

Reply.

Mr. Richardson Cross, in thanking the foreign visitors and members for their valuable experiences, expressed his sat-

isfaction that the general opinion had been strongly expressed against the retention of dangerous eyeballs, or the hopeless efforts sometimes made to save them to the detriment of the other. With regard to the pathology of sympathetic cases the speakers all seemed to agree with him that neither the microbic theory nor that of reflex neurosis was definitely proved. There was a possibility that when scientific investigation was more perfect various kinds of microbes might be found implicating, if not actually causing, sympathetic complications. It seemed to him necessary to work carefully in the direction of seeing how far any general infection of the system (blood or organs) was present where septic uveitis had been developed in the sympathizing eye.—*British Medical Journal.*

PAMPHLETS RECEIVED.

"Neurasthenia," by J. Punton, M.D.

"Benign Laryngeal Tumors," by J. M. Ingersol, M.D.

"Our Work and Its Limitations, by E. C. Runge, M.D.

"Creuznach-Spa and Its Environments, Its History Past and Present."

"Modern Therapy of the Tympanic Cavity," by M. A. Goldstein, M.D.

"Brief Report of a Case of Fibroma of the Eyelid," by Ch. A. Oliver, M.D.

"Annual Report of the Milk Inspector of the City of St. Louis," by H. Carter, M.D.

"The Failure of Antitoxin in the Treatment of Diphtheria," by J. E. Herman, M.D.

"The Importance of Minor Choroiditic Changes, Especially Conus," by B. A. Randall, M.D.

"Five Hundred and Fifty Surgical Operations Without Alcohol, by Ch. G. Davis, M.D.

"A Review of D. W. Beaumont's Experiments on Alexis St. Martin," by S. C. Ayres, M.D.

"Retinoscopy a Crucial Test in Measuring Errors of Refraction," by B. A. Randall, M.D.

"Report on Formaldehyd Disinfection in a Vacuum-chamber," by E. K. Sprague, U.S.M.H.S.

"Hydrophthalmus; A Bibliographic, Clinical, and Pathological Study," by W. L. Pyle, M.D.

"Description of an Adjustable Bracket for the Reid Ophthalmometer," by Ch. A. Oliver M.D.

"A Brief Note on a Case of Reflex-Irritation (Urticaria and Eyestrain)," by Ch. A. Oliver, M.D.

"The Late Result in a Case of Implantation of Sponge in the Orbit After Enucleation," by S. D. Risley, M.D.

"Hyperostosis Cranii, with the Report of a Case Leading to Exophthalmus and Blindness," by F. W. Ellis, M.D.

"Description of a New Method for the Implantation of Glass Balls into the Orbital Cavity," by Ch. A. Oliver, M.D.

"Notes historique sur la clinique d'ophtalmologie de l'université royale hongroise de Budapest," by W. Schulek, M.D.

"Synechiotomy of the Stapes for Improving the Hearing in Chronic Suppurative Otitis Media Residua," by E. B. Deuch, M.D.

"Restoration of the Conjunctival Cul-de-sac in a Case of Total Symblepharon by Means of Thiersch Skin Grafts," by Ch. H. May, M.D.

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